

DETAILED ACTION

The amendment filed on September 01, 2009 under CFR 1.312 has been entered.

Status of Application

The new, amended and original claims 7, 21-23 are pending and presented for the examination. The original claims 1-6 and 8-20 have been cancelled.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7, 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hisaji et al JP 10 168502 (JP'502) in view of Shotaro et al JP 2000 128648 (JP'648).

Regarding Claim 7, JP'502 teaches a method of producing a carbon nanotube (claim 4 and 11), dispersed (page 5 para 0013) composite material (Title, Claim 1, 2), metal powder (claim 1 and claim 3), carbon nanotubes (claim 4, 11) in an amount of 1-200 wt% (claim 2) by a ball mill (claim 12), hot pressing at 20-1500°C (para 0015), a pressure of 10000 kg/cm² (para 0016), at a suitable temperature and compacting pressure (para 0016).

Examiner considers that, based upon the teaching of JP'502 and as known in the art, ball milling produces "kneading and dispersing" since the material is vigorously mixed in the presence of ceramic or alloy ball media.

Although JP'502 teaches hot pressing at a suitable temperature (Page 5 para 0016) and pressure (claim 5, para 0016), JP'502 does not explicitly teach sintering by discharge plasma.

JP'648 teaches discharge plasma sintering method (Abstract, claim 1) to obtain the sintered body and sintering by hydrostatic pressurization with electric discharge plasma (claims 2 and 3), hydrostatic pressurization 0.1-20 tf/cm² (page 6 para 0032).

JP'648 further shows the punches of the die (Figure 3 and 4), further teaches "pressurized by pressure...and pulse voltage was impressed" (para 083).

At the time of invention, it would be obvious to a person of ordinary skill to synthesize the carbon nanotube composite material (JP '502) utilizing the discharge plasma (JP '648). The suggestion or motivation for doing so would have been to make a homogenous compact body that has low defect ("..without a sintering defect.." JP'648).

Examiner considers that pressure is applied during the compaction of the carbon nano tubes dispersed in ceramic; subsequently, a green body is formed. Sintering of the green body produces the final product. A green body can be formed even at a zero

pressure; however such a green body would have high internal porosity that would result inhomogeneous compact body. A higher compaction pressure leads to a homogeneous compact body compared to no pressure or a low pressure. JP'502 teaches compaction pressure as high as 10000 kg/cm^2 (para 0016 page 5) where as JP'648 teaches compaction pressure in the range of $0.1 - 20 \text{ tf/cm}^2$. The lower value of the range, for example 0.1 tf/cm^2 , may be considered as low pressure in the first stage of compaction. A second stage of compaction consisting the pressure close to the upper range, for example 20 tf/cm^2 or close to 10000 kg/cm^2 may further reduce the internal porosity and make a homogenous compact body as suggested by JP'648.

Regarding claim 21, JP'648 teaches sintering temperatures in the range of 300°C to 1500°C (para 0068).

Regarding claim 22, JP'648 teaches the sintering under the pressure of 0.1 to 20 tf/cm (para 0032), 2 tf/cm^2 (para 0071) and 400 kgf/cm^2 (para 0075).

Regarding claims 21 and 22 in view of the claim limitations of 500°C to 2000°C and 10 to 100 MPa , respectively, examiner considers: In MPEP 2144.05 [R-5] Obviousness of Ranges, "In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists".

Regarding claim 23, JP'648 teaches two sintering steps: first step is to make the green body (para 0066) where the pulse ratio is between 1:1 to 12:1 (para 0067) and pressure is 80-2000kgf/cm²; second step is further sintering of the 'green body' at a pressure of 400 kgf/cm², sintering temperature of 1050°C and retention time of 10 minutes.

Regarding the claim limitations of 15 to 20 MPa and 30 to 60 MPa, Examiner considers: In MPEP 2144.05 [R-5] II OPTIMIZATION OF RANGES “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.”

Summary

The claims 7, 21-23 are rejected.

Response to Arguments

Applicant's arguments filed September 01, 2009 have been fully considered but they are not persuasive.

In view of cancellation of claim 15, examiner has withdrawn the 35 USC § 112 rejection.

Applicants argue multiple times the material composition (carbon nano tube vs. graphite), heat conductivity, electrical conductivity; and superior heat conductivity. Applicants argue: "Applicant is concerned not only with the heat conductivity but also with electrical conductivity and strength properties".

Examiner would like to point out that the claims 7 and 21-23 are drawn to a process of producing carbon nano tube dispersed composite material. Nowhere claims have any limitations of heat conductivity, electrical conductivity and superior heat conductivity and strength. The claim limitation of "excluding alumina" and "excluding aluminum and its alloys" have been met by the prior art.

Applicants argue about the graphite material vs. the carbon nano tubes. Examiner considers that the chemical composition of graphite and carbon nano tune is same: carbon. Further, JP'502 clearly states: "crystalline carbon material (**graphite**, carbon black, fullerene, **carbon nano tube**, etc." (emphasis added).

Applicants argue multiple times about the die, punch, sintering and hot pressing. The complete process of discharge plasma sintering has been explained by JP'648 via

the process, experimental parameter, 2-step sintering and, finally, the design of the fixture (particularly, examiner points out, Figure 4, part 3 75, 72, 73, 1, 4 and 2).

Applicants argue about the granularity of the starting material and oxides vs. nitrides. Examiner would like to point out that the claims 7 and 21-23 are drawn to a process of producing carbon nano tube dispersed composite material. The only negative limitation of alumina (aluminum oxide) has been met by the prior art.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BIJAY S. SAHA whose telephone number is (571) 270-5781. The examiner can normally be reached on Monday- Friday 8:00 a.m. EST - 5:00 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis Mayes can be reached on (571) 272 1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BIJAY S SAHA/
Examiner, Art Unit 1793

BSS

October 24, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793